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Spatial patterns of soil erodibility through soilscapes in land systems of Lake Tana catchment (Ethiopia)

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Abstract

This presentation draws up the logic of the soilscapes of different land systems in Lake Tana basin. It aims at answering three questions: “Which major soil types are found at which positions in the landscape”, “How can this distribution be explained”, and “How is the spatial pattern of soil erodibility in these soilscapes” .
The soils and geomorphology of the basin are characterized by a volcanic past. Basaltic and lacustrine parent materials are dominating the basin and influencing the soil-landscape. Most Vertisols and Fluvisols developed on the lacustrine deposits or in the alluvial plains. The alkali basalts from the Oligo-pliocene (Tertiary trap series) are characterized by different soil types with Nitisols and Leptosols as dominating groups. Nitisols are also the dominant soil type on the alkali basalts from the Quaterary (Quaternary Aden series). Those Nitisols are typical for slopes and higher well-drained positions of the landscapes.
We use the knowledge on soil distribution to study the K-factor in the Revised Universal Soil Loss Equation (RUSLE). The soil erodibility was estimated using (1) the approach of Renard et al. (1997) based on soil texture, organic carbon content, soil structure and permeability and (2), by Rőmkens et al. (1997) using only texture as input. A logarithmic relationship was found between rock fragment cover (%) and slope gradient (%) for cultivated land (R^2=0.58). Rock fragment cover protects the soil against aggregate breakdown, raindrop impact and supports the soil structure as well, lowering the effect of increased soil erosion on slopes.
Structure and rock fragment cover seemed to be the most important soil properties influencing their erodibility. There is no evidence that soil texture and organic matter are contributing to a statistical difference of K-factors between soil group or geomorphological units in this basin. This fact is not related to the smaller importance of soil texture but rather to the relatively homogeneous soil texture composition of the basin.
According to the formula of Renard et al., accounting for the Nitisols revealed to be significantly more erodible than the other soil types of the basin ($p=2.10^{-6}$), for two main reasons being (1) the nutty, blocky structure and (2) the low rock fragment cover. No statistical differences were measured when using the formula based on textural data only.